

owhere is the potential for renewable resources more visible than in wind energy. Iowa is the tenth windiest state in the nation, with nearly 40 percent of its land area offering wind generation capabilities. The state has the potential to produce 4.8 times its

own annual electrical consumption through wind power.² Because of decreasing capital costs, new technological advances, and favorable legislation, wind power is Iowa's — and the world's — fastest growing renewable resource.³

Wind is an economically feasible energy resource in many settings. In Iowa, electricity produced from wind currently costs between \$.04 and \$.05 per kWh, down from about \$.35 per kWh in the 1980s.⁴ Compared to other renewable resources, wind represents one of the least expensive resources for electricity production.

Wind power has also become a model for how renewables can move from demonstration to commercialization. In 1993, Spirit Lake School District was the first school to install a wind turbine to offset electricity costs. The success of the first turbine prompted the school district to make plans for a second turbine, which was installed in 2001. When both turbines have been paid for by 2007, the school district will have \$120,000 in annual tax-free income.⁵ Additionally, Waverly Light and Power was the first municipal utility in the Midwest to install a wind turbine, also in 1993.

The installation of these turbines sparked widespread interest and public acceptance. Several organizations, including seven school districts and nine municipal utilities, as well

DEFINITION

Wind is produced by the uneven heating of the earth's surface. As wind blows, the kinetic energy (the energy in moving air) can be captured by a turbine and converted to electricity.

as private individuals and businesses, have installed or are in the process of installing wind turbines.

In 1983, the state of Iowa passed the Alternative Energy Production Law, requiring investor-owned utilities to purchase 105 MW of power annually from renewable energy sources. Because of Iowa's strong wind potential — and the technology's cost effectiveness — utilities have chosen wind power to help meet this requirement. By June 1999, 257 wind turbines in Buena Vista and Cherokee counties, and 55 turbines in Cerro Gordo County began producing electricity. In 2001, an additional 89 turbines began producing electricity in Worth County.

The advantages of wind energy are its environmental benefits (air pollutants are not emitted when electricity is produced from wind), the ability to take advantage of Iowa's natural resources, and decreasing operational and installation costs. Other advantages are the ability for a producer to offset energy needs, and the income potential for Iowa property owners who lease land to wind developers for turbine installations. Because of developing wind assessment and forecasting technologies, wind energy also can be planned into utility generating mixes in the near future.



Measuring Progress

- From 1999 to 2001, wind energy production increased 33 percent in Iowa.⁷
- Iowa is the tenth windiest state in the nation.⁸
- Electricity produced from wind energy in Iowa costs between \$.04 and \$.05 per kWh, down from \$.35 per kWh in the 1980s.⁹
- Iowa has the potential wind energy capacity to produce 5.2 percent of total U.S. consumption annually, 10 and more than 4.8 times its own energy consumption. 11
- When wind speed doubles, the amount of energy in the wind increases eight times.¹²



Consider this...

As of July 1, 2002

- Total Iowa Nameplate Wind Capacity: 335 MW
- Actual Wind Capacity: 100.5 MW (Determined at 30 percent of nameplate capacity due to intermittancy of wind speeds)

Project Descriptions

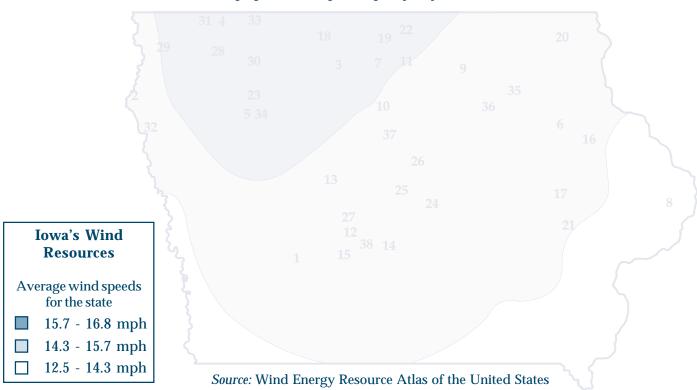
- The Clarion-Goldfield School District installed a 50 kW wind turbine near its high school in Clarion, and began producing electricity in June 2002. The school is planning to create a physics/renewable energy curriculum that includes monitoring of the turbine's electricity production, wind speeds and posting of the information on the district's Web site.
- Two municipal utilities, Lenox and Wall Lake, will install wind turbines in the next two years, with funding help from the Iowa Department of Economic Development.
- Top of Iowa Wind Farm, owned by Northern Iowa Windpower, consists of 89 900 kW wind turbines and is located in Worth County. This 80.1 MW facility will produce about 240,000 MWh per year. Alliant Energy is purchasing the power from the wind farm, which became operational in 2001.
- MidAmerican Energy and Alliant Energy are purchasing the energy generated from 257 wind turbines in Cherokee and Buena Vista counties. The 750-kW turbines, now owned by GE Wind, were operational in June 1999. Alliant Energy is currently looking into two new windprojects near Spirit Lake and in Hancock County.
- Alliant Energy is purchasing power produced from 55 wind turbines in Cerro Gordo County. FPL Energy Inc., Florida, owns the 750-kW turbines, which were operational in June 1999.
- Forest City Community School District and Akron-Westfield Community School District each constructed 600 kW wind turbines to offset electricity use in January 1999. Forest City received a portion of its financing from the DNR's Iowa Energy Bank Program, with estimated energy savings of \$50,000 in 2001.¹³ Akron-Westfield's turbine is projected to save more than \$60,000 annually.¹⁴
- The Iowa Energy Center (IEC) has established 14 wind data collection sites across Iowa. Two stations are moved annually to measure uncharted areas of the state. The IEC creates maps and charts on Iowa's wind resources and posts information on its Web site. Individuals can estimate their own location's wind speeds at: www.energy.iastate.edu
- The DNR completed studies on wind hybrid technology to create solutions regarding the intermittency of wind, and on the potential of transmitting wind energy to high load centers in the Midwest. Go to: www.state.ia.us/dnr/energy/programs/wind





Wind Energy Production Sites in Iowa

Total projected nameplate capacity July 2002: 335 MW



- 1. Adair 225 kW, Schafer Systems, Inc.
- Akron 600 kW, Akron-Westfield Community Schools
- 3. Algona 2.25 MW, Municipal Utilities Cooperative Project
- 4. Allendorf 9.0 MW, GE Wind
- 5. Alta 193 MW, GE Wind; 1.5 MW, Waverly Light and Power
- **6. Aurora** 13 kW, Private Owner
- 7. **Britt** —195 kW, Private Owner
- 8. Bryant 40 kW, Private Owner
- **9. Charles City** 10 kW, Private Owner
- Clarion 50kW, Clarion-Goldfield Community Schools
- 11 Clear Lake 42 MW, FPL Energy
- **12. Dallas Center** 20 kW, Private Owner
- 13. Dana 65 kW, Private Owner
- **14. Des Moines** 10 kW, Iowa State Fairgrounds
- **15. Earlham** 40 kW, Private Owner
- **16. Earlville** 10 kW, Private Owner
- 17. Ely 20 kW, Private Owner
- **18. Fenton** 65 kW, Sentral Community Schools
- **19. Forest City** 600 kW, Forest City Community Schools

- **20. Highlandville** 10 kW, Private Owner
- **21. Iowa City** 20 kW, Private Owner
- **22. Joice** 80 MW, Northern Iowa Windpower
- **23.** Linn Grove $10 \, \mathrm{kW}$, New Prairie Home Technologies
- **24. Melbourne** 18 kW, Private Owner
- **25.** Nevada 450 kW, Nevada High School, 250 kW, Story County Hospital
- **26.** New Providence 10 kW, Private Owner
- **27. Perry** 10 kW, Private Owner
- **24. Primghar** 10 kW, Private Owner
- **29. Rock Valley** 17 kW, Private Owner
- **30. Royal** 95 kW, Clay Central-Everly Community Schools
- **31. Sibley** 1.32 MW, Navitas
- **32. Sioux City** 65 kW, KTFC Midwest Bible Radio
- **33. Spirit Lake** 1.0 MW, Spirit Lake Community Schools
- **34. Storm Lake** 12 kW, Private Owner
- **35.** Sumner 10 kW, Private Owner
- **36.** Waverly 900 kW, Waverly Light & Power
- **37. Williams** 65 kW, Boondocks Truck Stop
- **38.** West Des Moines 10 kW, Sun Prairie Âpts.



How It Works

As wind passes through spinning blades on a turbine, a rotor captures the kinetic energy of the wind and converts it into rotary motion. This motion drives a generator, producing electricity for use at the location. ¹⁵ It is also often fed into a utility grid for use by all consumers.

The amount of energy in wind is a function of wind speed. Wind speed varies with the seasons, time of day, and region. Wind turbines are often built on towers 100 feet high or more because turbulence is greater close to the ground. ¹⁶ Due to the itermittency of wind, turbines in Iowa produce wind energy at about 30 to 40 percent of their full capacity potential. ¹⁷

An important factor in wind produc-

tion is assessing the wind potential of a geographic region. The National Renewable Energy Laboratory has established a seven-class rating system on wind speeds, with "class seven" having the strongest wind ranking. Most of Iowa is rated as a "class three," with average wind speeds of 14.3 to 15.7 miles per hour. However, northwest Iowa is rated as "class four" with wind speeds of 15.7 to 16.8 mph. 18 This is relevant because the wind power in "class four" is 27 percent greater than in "class three." 19

The Real World

The energy produced by approximately 400 turbines in Buena Vista, Cerro Gordo and Worth counties is enough annually to:

- power 103,600 homes
- avoid 1,100,500 tons of CO₂ annually
- keep \$10.1 million from being exported from Iowa to pay for fossil fuels
- displace 567,356 tons of coal each year for electricity production

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